

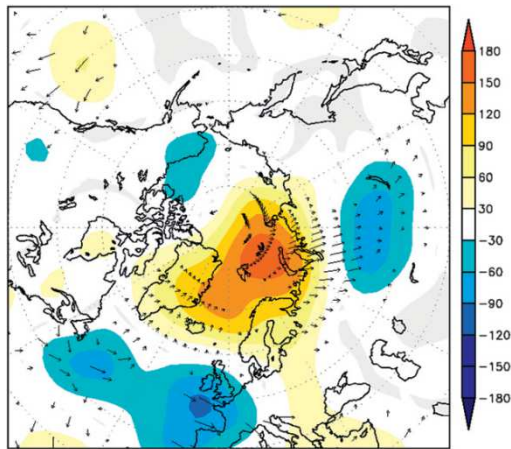


On polar-nonpolar linkages: observations and model diversity (eastern Arctic sea-ice variability)

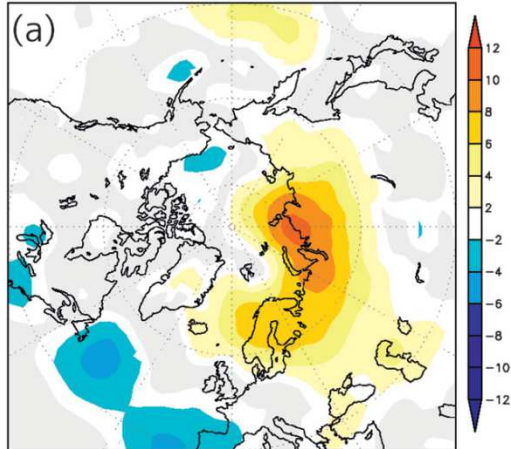
J. García-Serrano (LOCEAN/IPSL, **BSC**), [C. Frankignoul](#) (LOCEAN/IPSL)

with contributions/feedback: [OBS] [G. Gastineau](#) (LOCEAN/IPSL), [A. de la Cámara](#) (LMD/IPSL, NCAR)
[MOD] [A. Arribas](#) (MetOffice), [Y. Gao](#) (NERSC/BCCR), [V. Guemas](#) (BSC, CNRM), [M. P. King](#) (URC/BCCR),
[D. Matei](#) (MPI-M), [R. Msadek](#) (GFDL, CERFACS), [W. Park](#) (GEOMAR), [E. Sanchez-Gomez](#) (CERFACS)

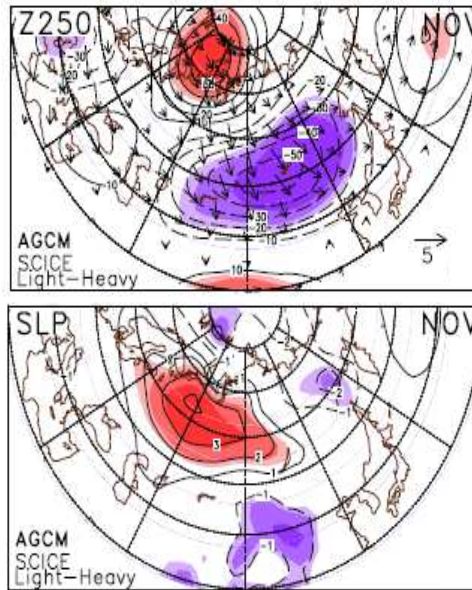
Z250 / WAF (DJF)



SLP_{key} anomaly (Ice_{light} - Ice_{heavy})

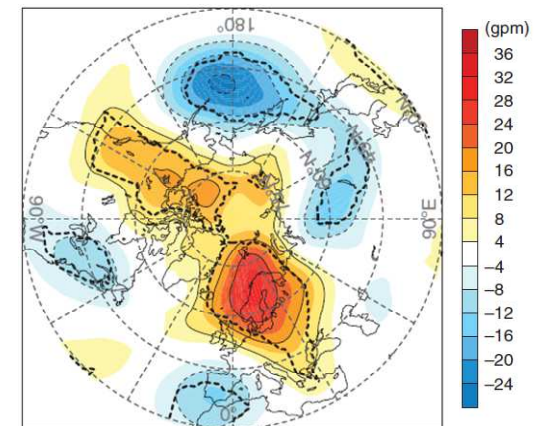


Inoue et al. (2012, GRL)

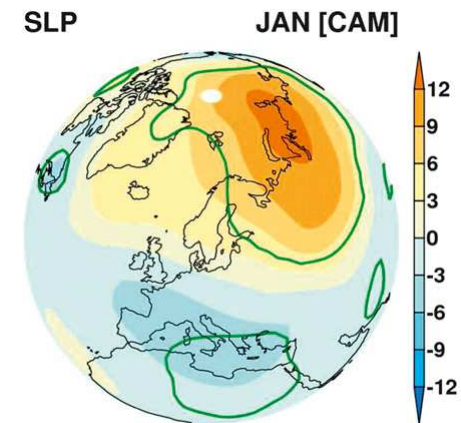


Honda et al. (2009, GRL)

$\Delta Z500$ for ND, CAM5



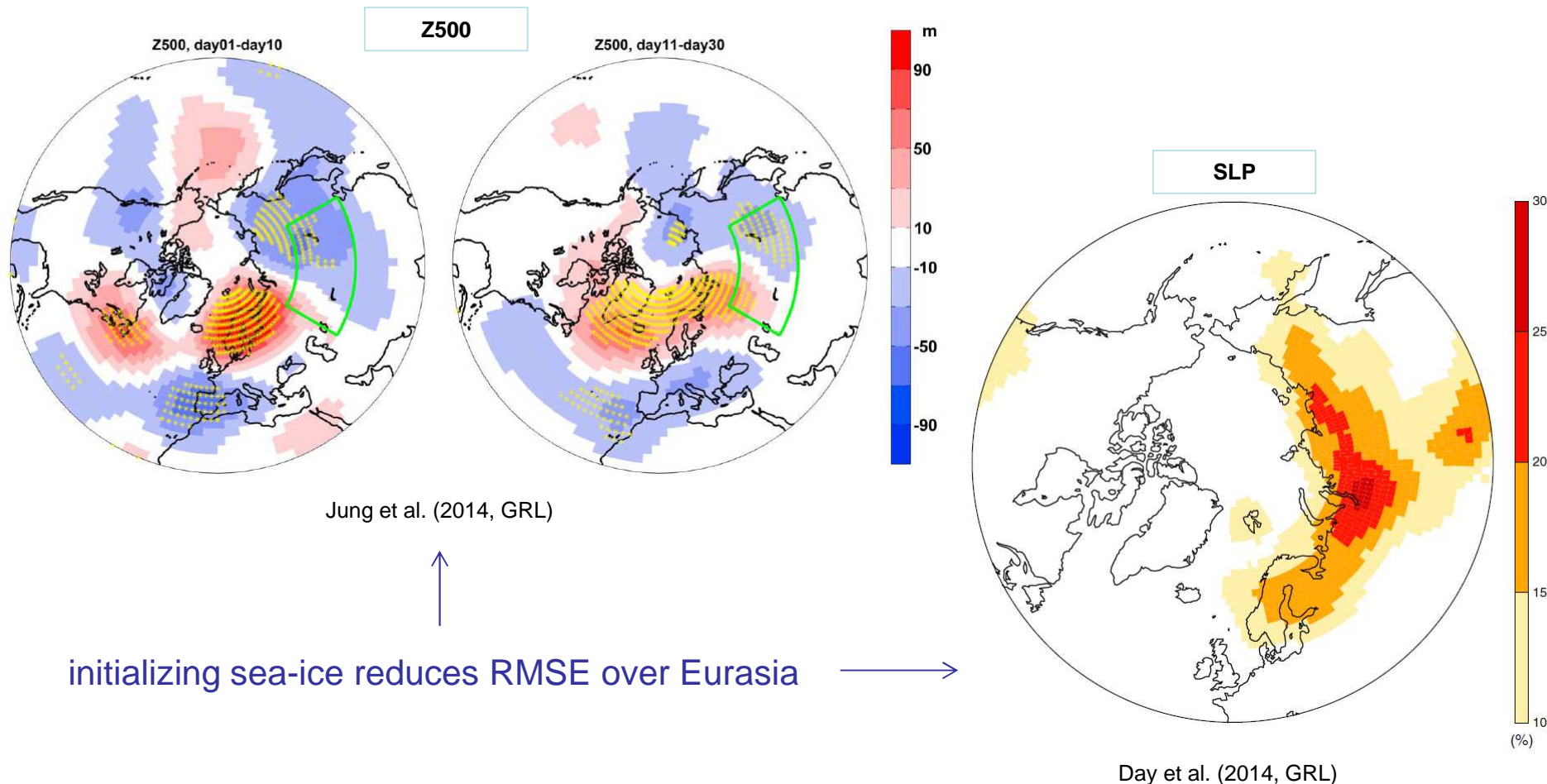
Kim et al. (2014, Nat.Comms)



Grassi et al. (2013, JCLIM) hPa

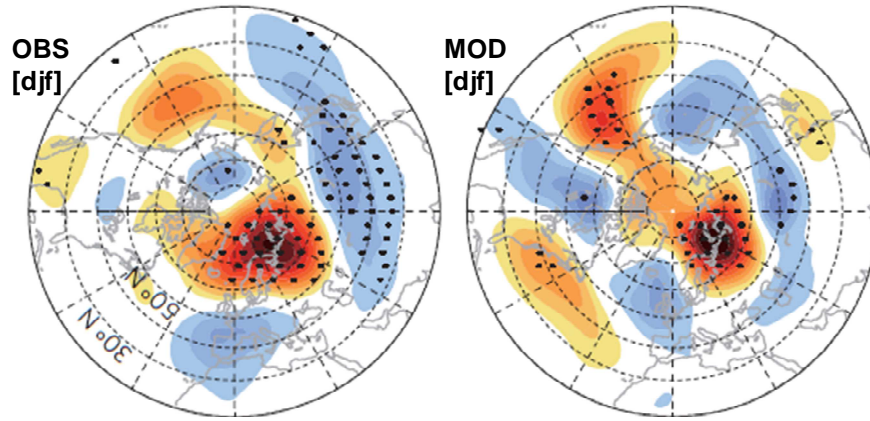
might be non-linear to SIC reduction!

Petoukhov and Semenov (2010, JGR)

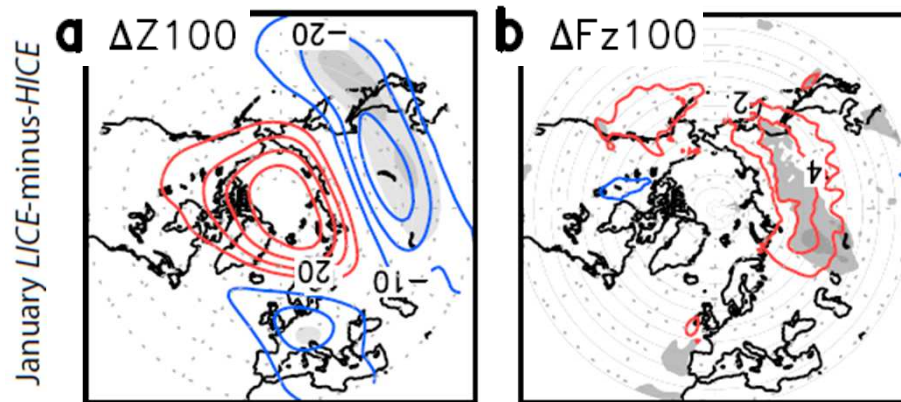


might be non-linear to SIC reduction!

Petoukhov and Semenov (2010, JGR)

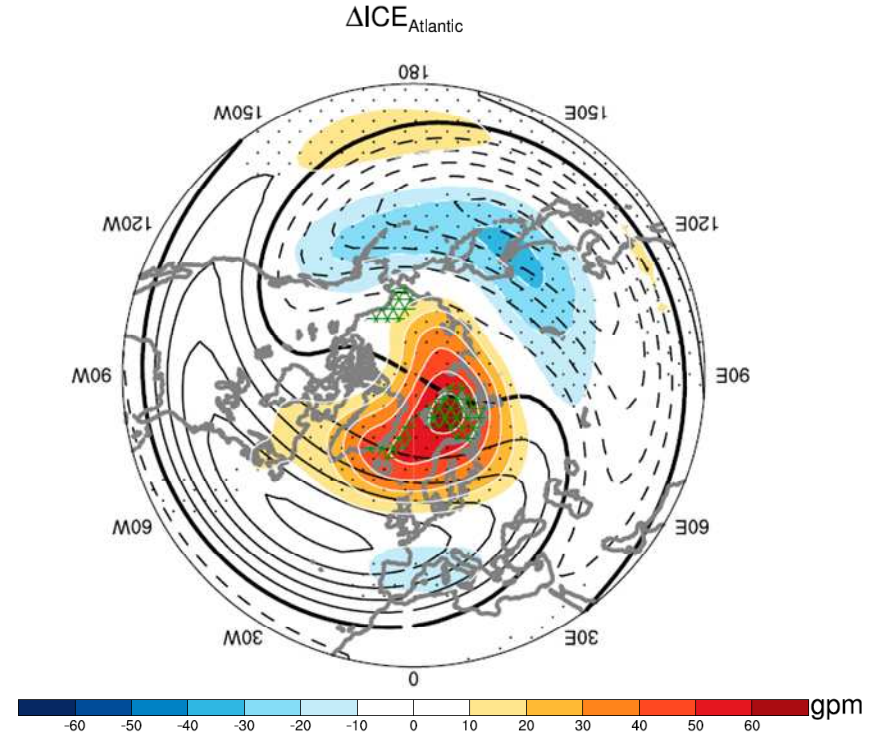


Mori et al. (2014, Nat.Geosci)



Nakamura et al. (2016, GRL)

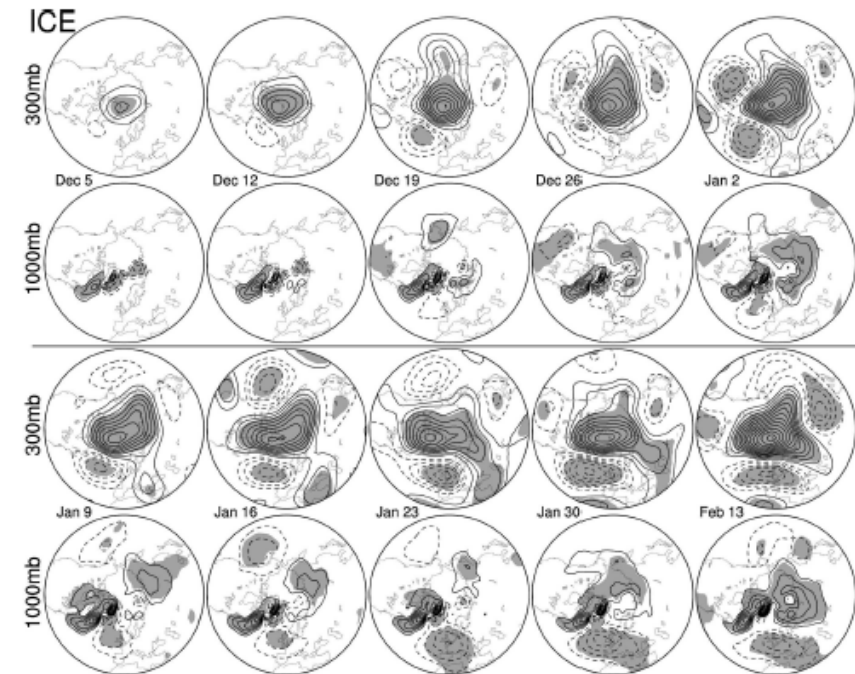
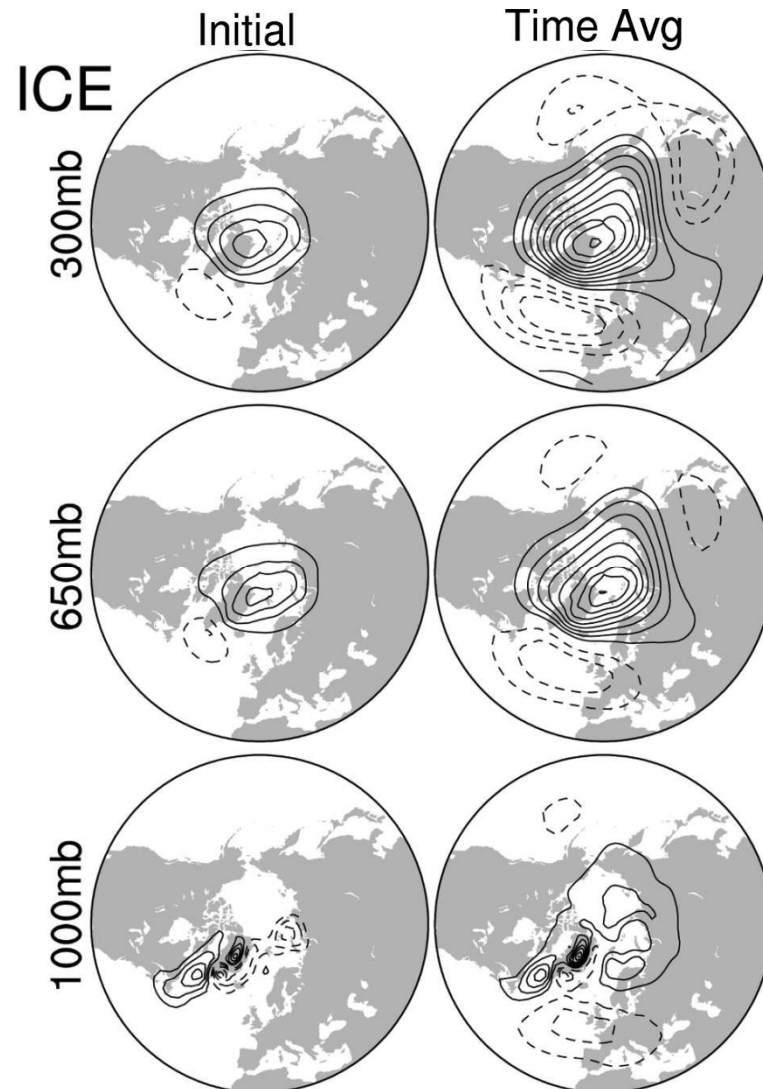
b) Z at 300 hPa Dec-Jan



Sun et al. (2015, JCLIM)

might be non-linear to SIC reduction!

Petoukhov and Semenov (2010, JGR)

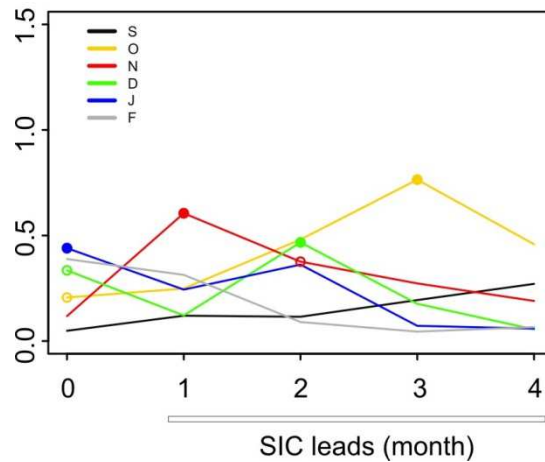


the equilibrium response to SIC reduction over G-B Seas, which projects on the negative NAO, is reached in about two months

Deser et al. (2007, JCLIM)

HadISST

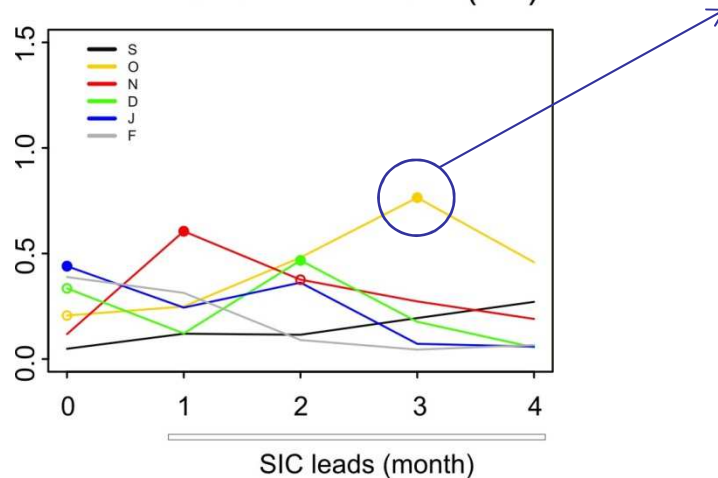
SC / east of Greenland (eG)



- detrended, monthly anomalies;
- period 1979-2013;
- target – cold season (Sep-to-Feb)

HadISST

SC / east of Greenland (eG)



might be linked to winter blocking over Eurasia

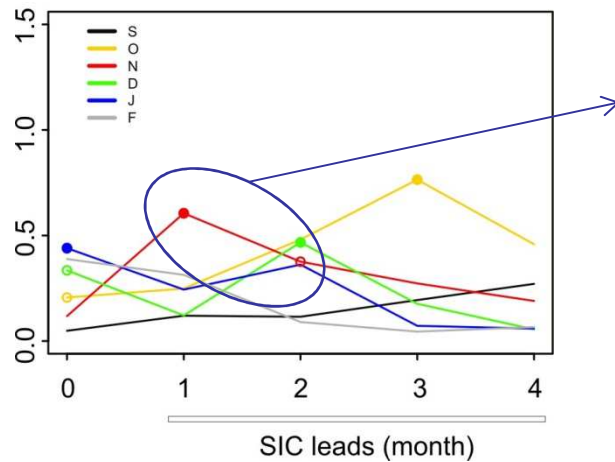
Mori et al. 2014 (Nat.Geosci); García-Serrano et al. (2015, JCLIM)

but the lead-time is longer than the expected atmospheric response time to SIC forcing

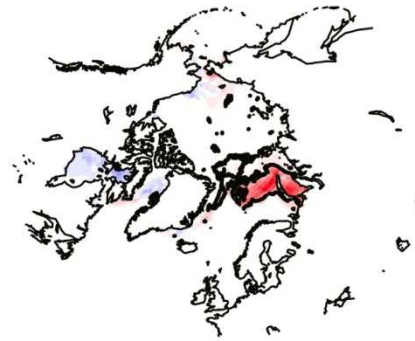
- detrended, monthly anomalies;
- period 1979-2013;
- target – cold season (Sep-to-Feb)

HadISST

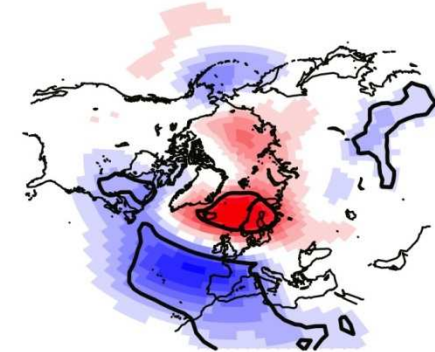
SC / east of Greenland (eG)



a) **MCA-SIC/eG_{NOV} X SIC (nov)**



b) **MCA-SIC/eG_{NOV} X SLP (jan)**

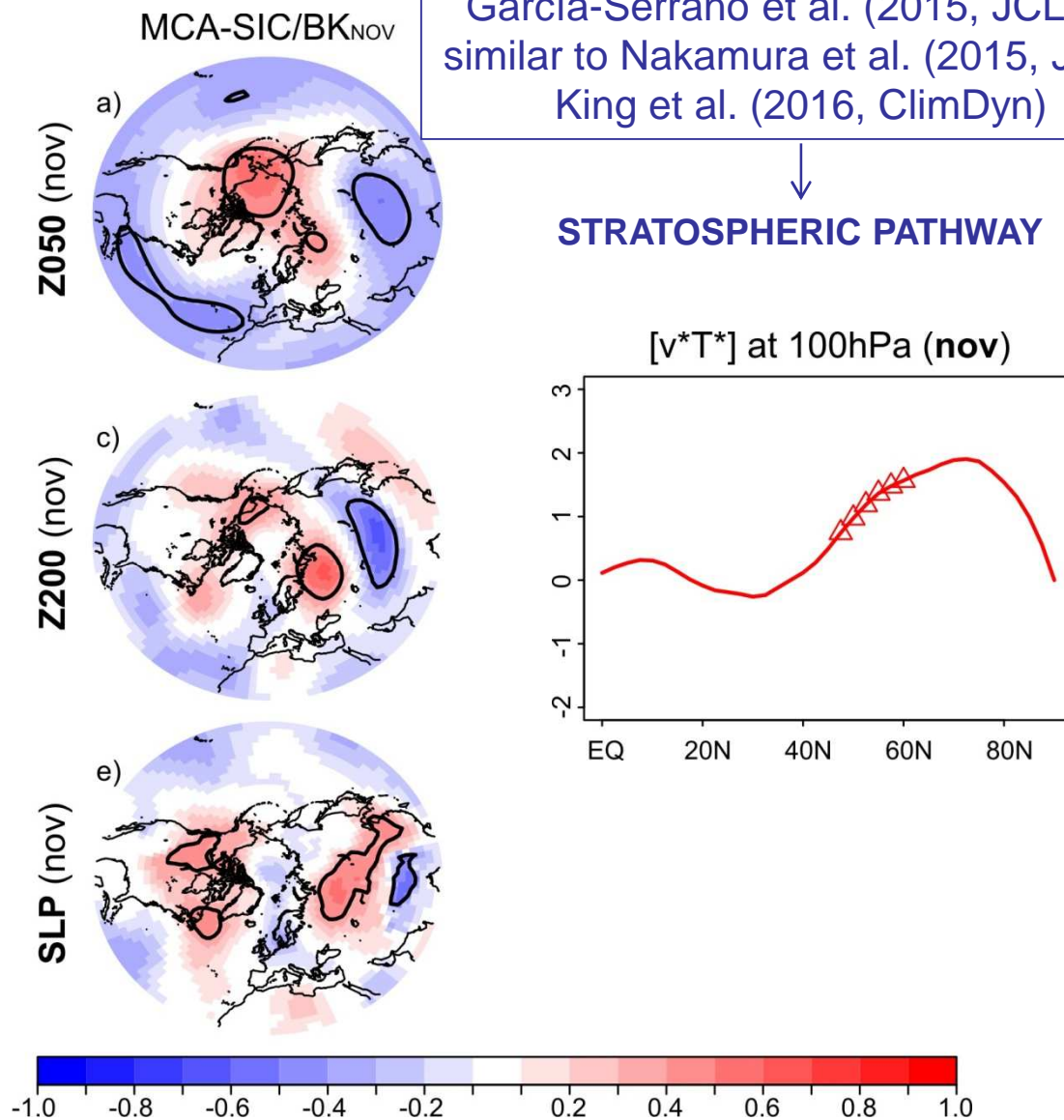


sig.lev.(SC)=6%

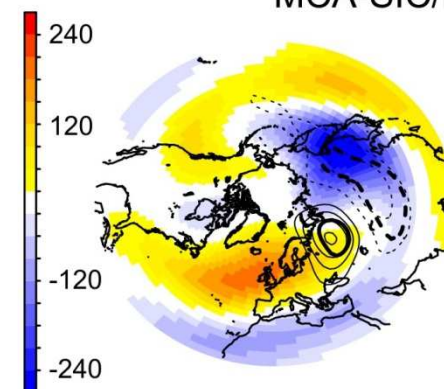
- detrended, monthly anomalies;
- period 1979-2013;
- target – cold season (Sep-to-Feb)

García-Serrano et al. (2015, JCLIM);
similar to Nakamura et al. (2015, JGR);
King et al. (2016, ClimDyn)

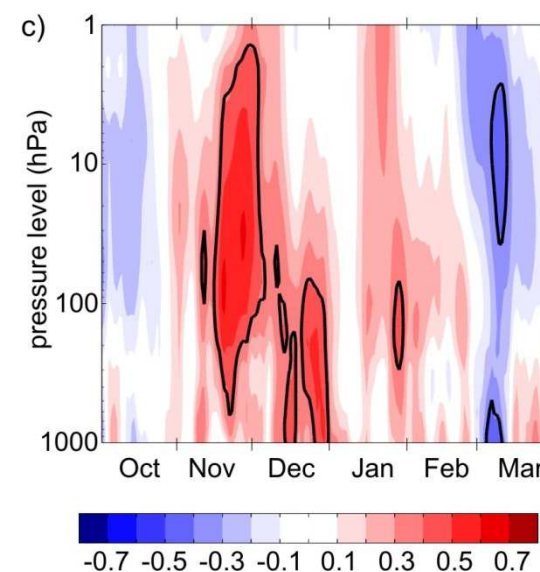
STRATOSPHERIC PATHWAY



b) Z200*(nov) climatology
MCA-SIC/BK_{NOV}

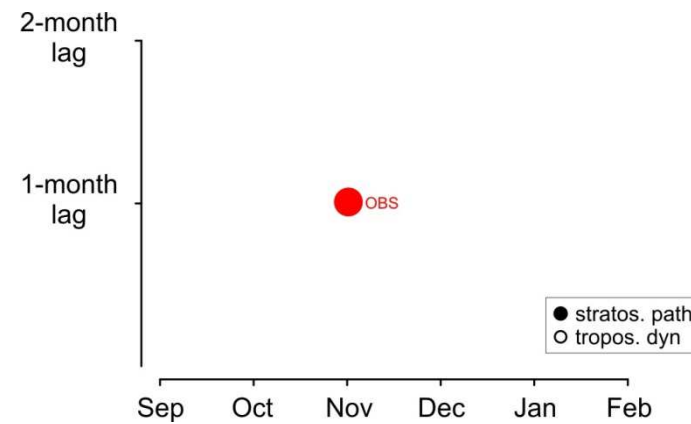


MCA-SIC/BK_{NOV} x HGT [60N-90N]



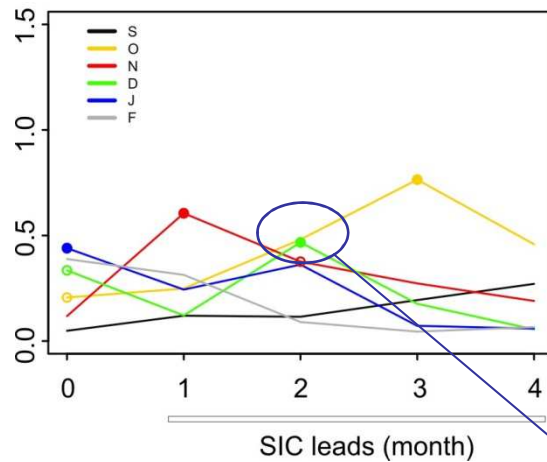


ECOMS Final Meeting (2016)



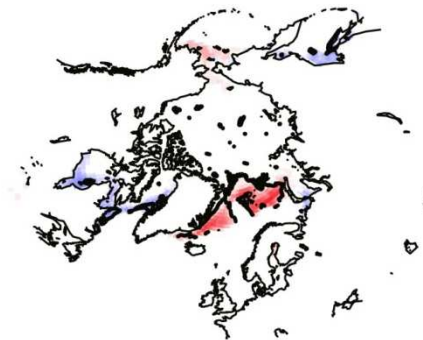
HadISST

SC / east of Greenland (eG)

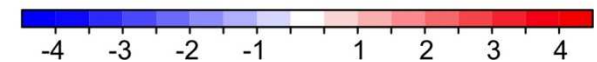
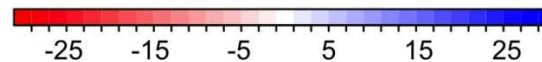
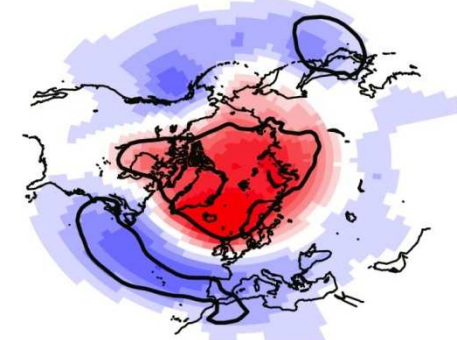


- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

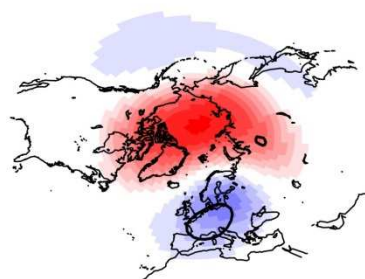
c) **MCA-SIC/eG_{DEC} X SIC (dec)**



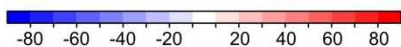
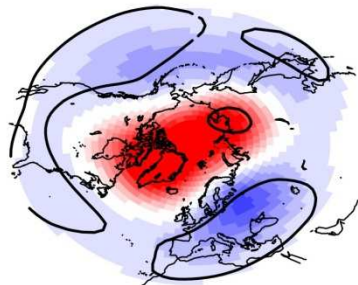
d) **MCA-SIC/eG_{DEC} X SLP (feb)**



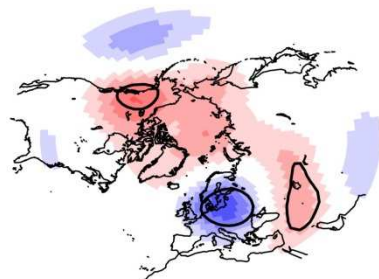
a) **SIC-GS_{DEC} X Z050 (jan)**



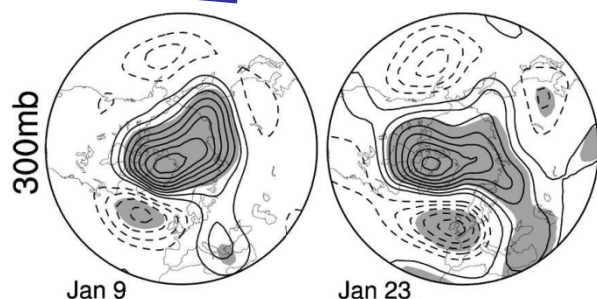
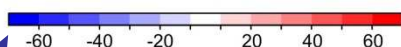
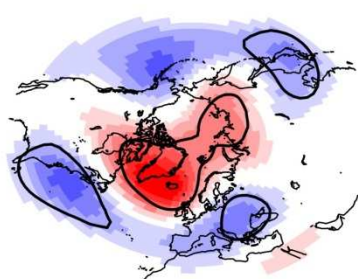
b) **SIC-GS_{DEC} X Z050 (feb)**



c) **SIC-GS_{DEC} X Z200 (jan)**



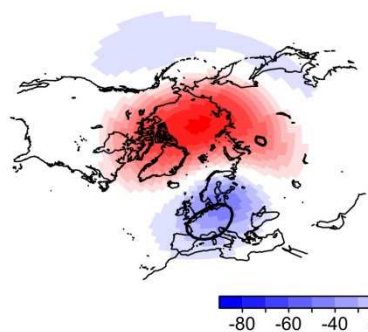
d) **SIC-GS_{DEC} X Z200 (feb)**



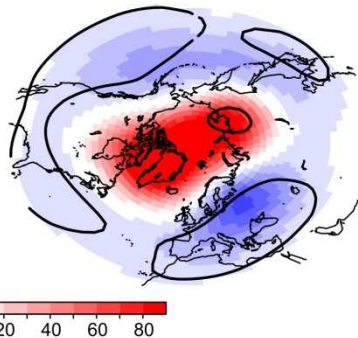
Deser et al. (2007, JCLIM)

García-Serrano and Frankignoul (2015, ClimDyn)

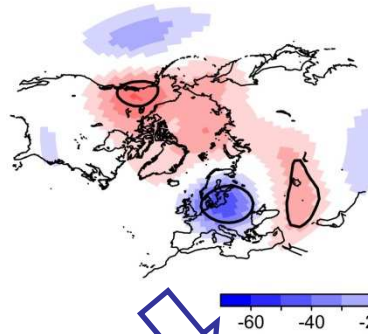
a) $\text{SIC-GS}_{\text{DEC}} \times \text{Z050 (jan)}$



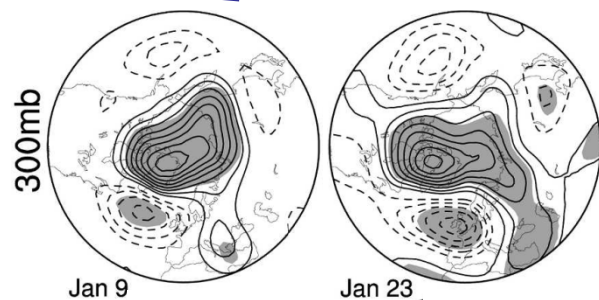
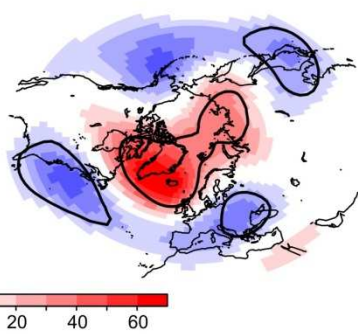
b) $\text{SIC-GS}_{\text{DEC}} \times \text{Z050 (feb)}$



c) $\text{SIC-GS}_{\text{DEC}} \times \text{Z200 (jan)}$

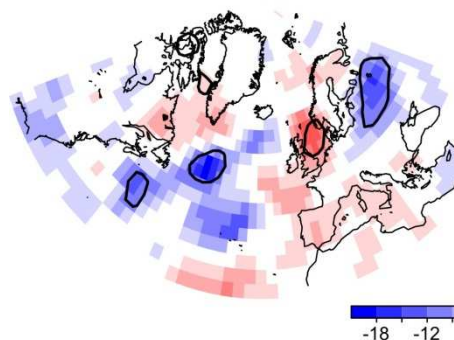


d) $\text{SIC-GS}_{\text{DEC}} \times \text{Z200 (feb)}$

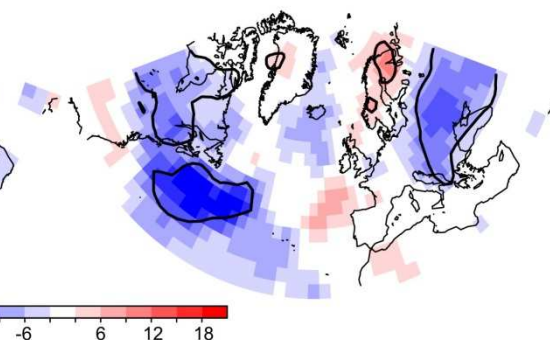


Deser et al. (2007, JCLIM)

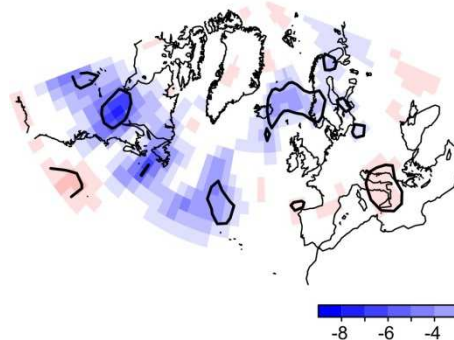
a) $\text{SIC-GS}_{\text{DEC}} \times \text{U'V'200 (jan)}$



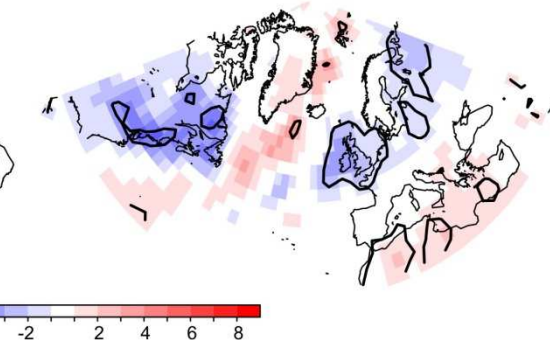
b) $\text{SIC-GS}_{\text{DEC}} \times \text{U'V'200 (feb)}$



c) $\text{SIC-GS}_{\text{DEC}} \times \text{V'T'850 (jan)}$



d) $\text{SIC-GS}_{\text{DEC}} \times \text{V'T'850 (feb)}$

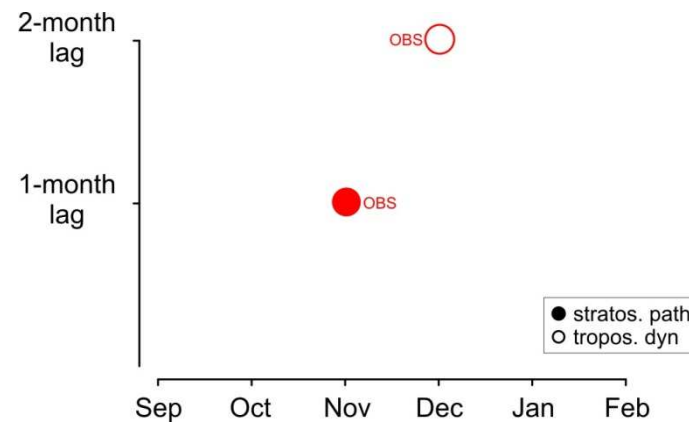


TROPOSPHERIC DYNAMICS

García-Serrano and Frankignoul (2015, ClimDyn)

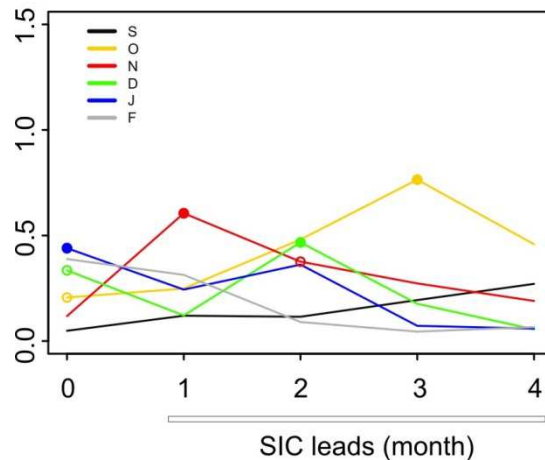


ECOMS Final Meeting (2016)



HadISST

SC / east of Greenland (eG)

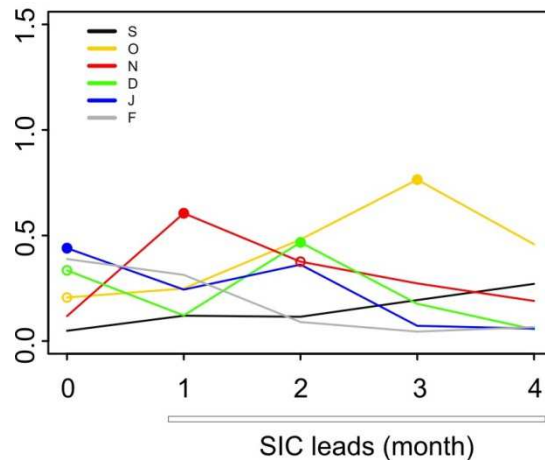


- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

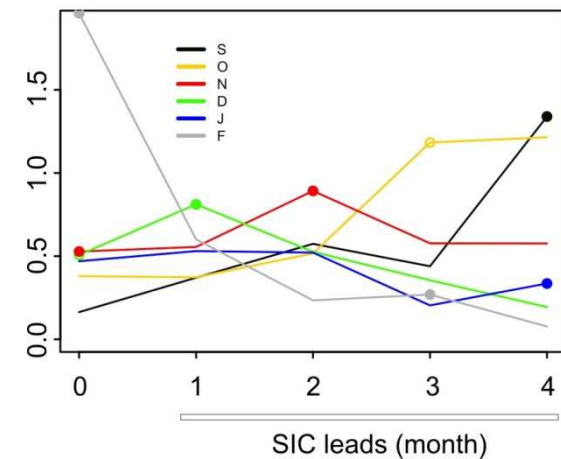
- **CMIP5**: no multi-model, each model individually;
CCSM4 (5mb), CNRM-CM5 (10mb), EC-EARTH2.3 (3mb), GFDL-CM2.1 (10mb), HadGEM2-ES (4mb), IPSL-CM5A-LR (3mb), MPI-ESM-MR (3mb), NorESM1-M (3mb) - HISTORICAL+RCP4.5 RUNS

HadISST

SC / east of Greenland (eG)



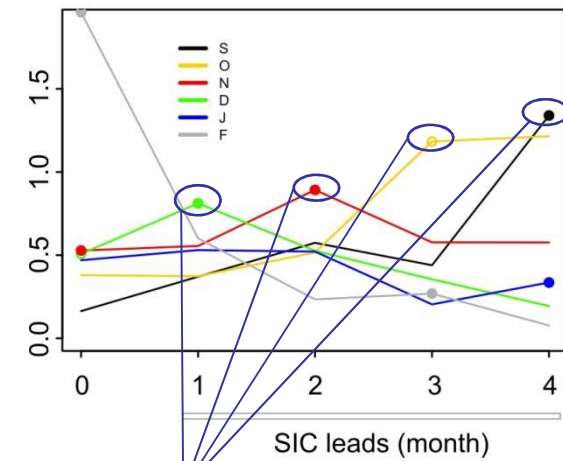
b) CNRM



- detrended, monthly anomalies;
period 1979-2013;
target – cold season (Sep-to-Feb)

- **CMIP5**: no multi-model, each model individually;
CCSM4 (5mb), CNRM-CM5 (10mb), EC-EARTH2.3 (3mb), GFDL-CM2.1 (10mb), HadGEM2-ES (4mb), IPSL-CM5A-LR (3mb), MPI-ESM-MR (3mb), NorESM1-M (3mb) - HISTORICAL+RCP4.5 RUNS

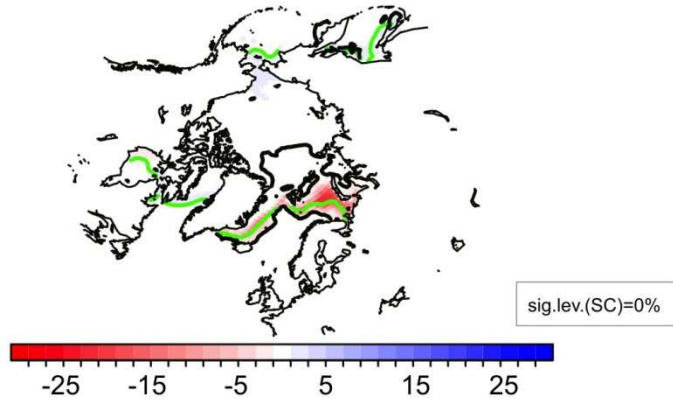
b) CNRM



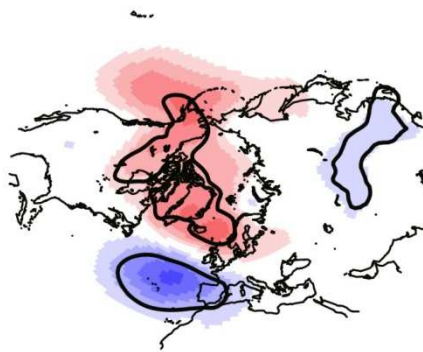
SIC persistence from Sep to Dec;
sig. influence on the atm. – Jan

CNRM

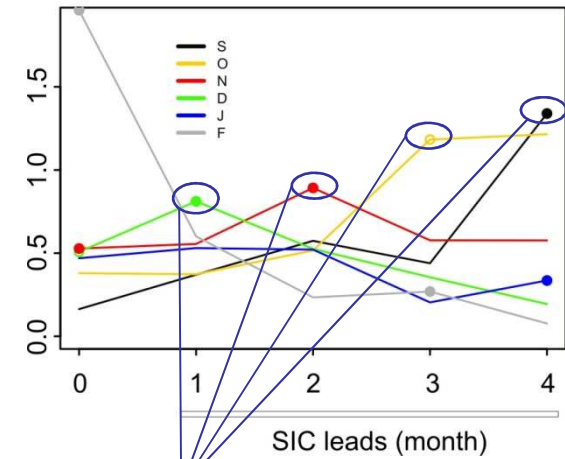
a) **MCA-SIC/eA_{DEC} X SIC (dec)**



b) **MCA-SIC/eA_{DEC} X SLP (jan)**



b) CNRM

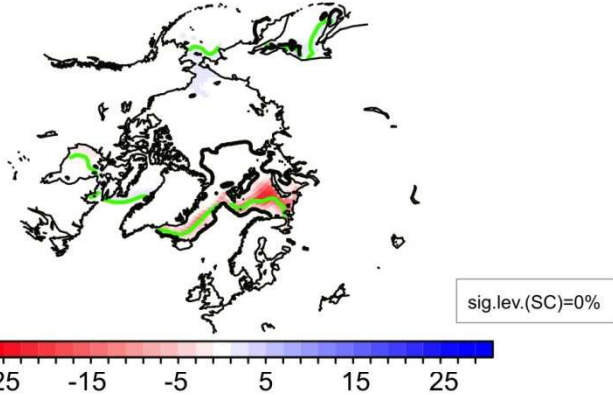


SIC persistence from Sep to Dec;
sig. influence on the atm. – Jan

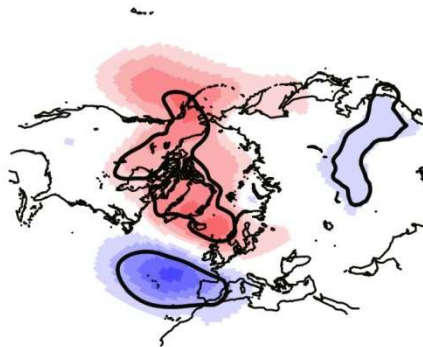
CNRM



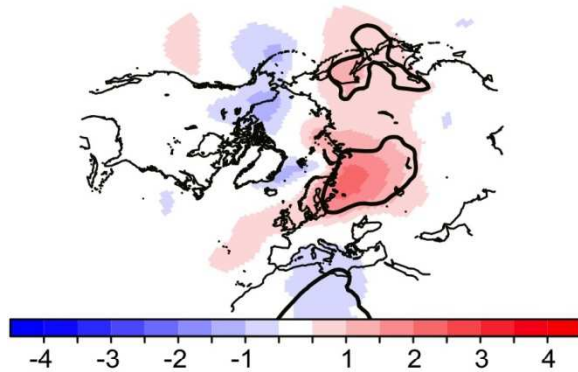
a) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SIC} (\text{dec})$



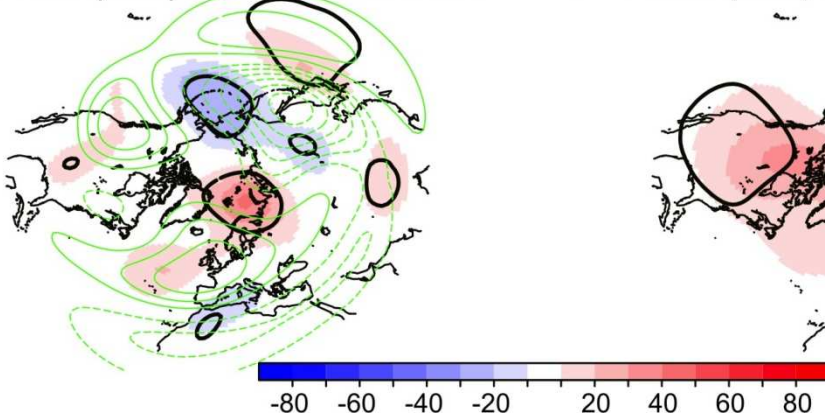
b) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SLP} (\text{jan})$



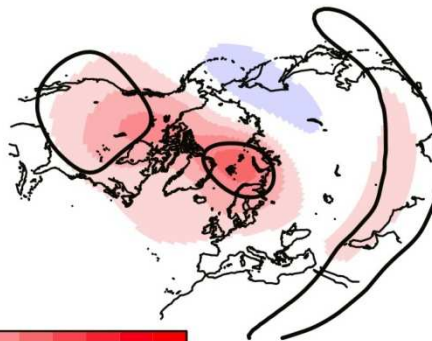
c) $\text{SLP} (\text{dec}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



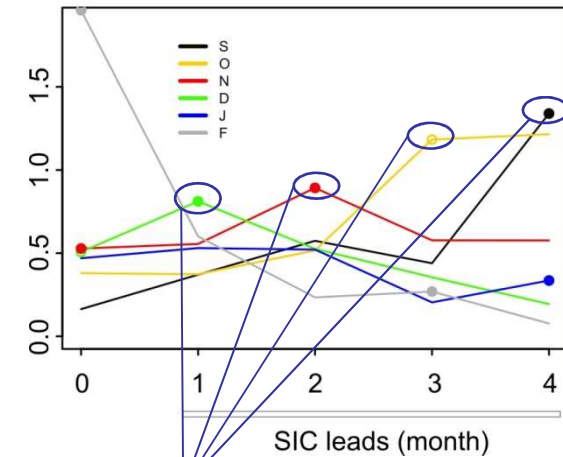
e) $\text{Z200} (\text{dec}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



f) $\text{Z050} (\text{dec}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



b) CNRM

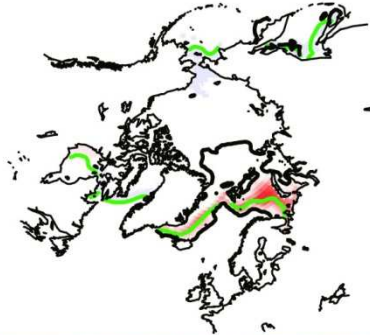


SIC persistence from Sep to Dec;
sig. influence on the atm. – Jan

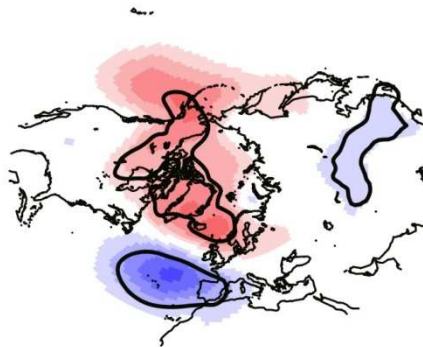
CNRM



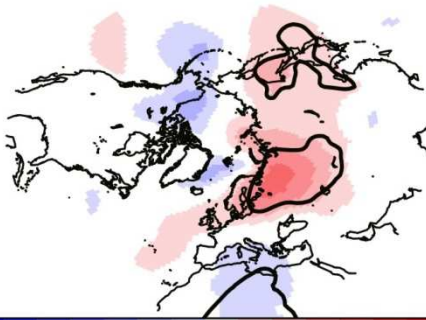
a) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SIC} (\text{dec})$



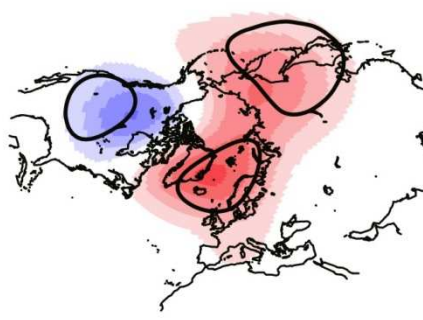
b) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SLP} (\text{jan})$



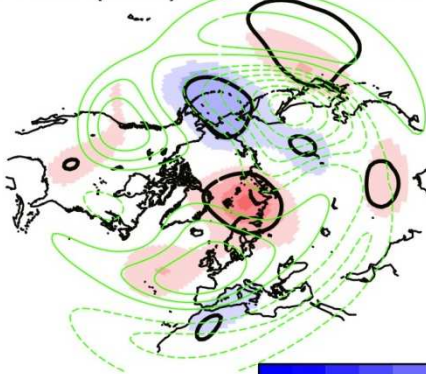
c) $\text{SLP} (\text{dec}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



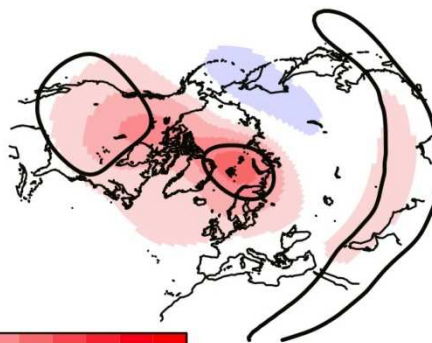
d) $\text{Z050} (\text{jan}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



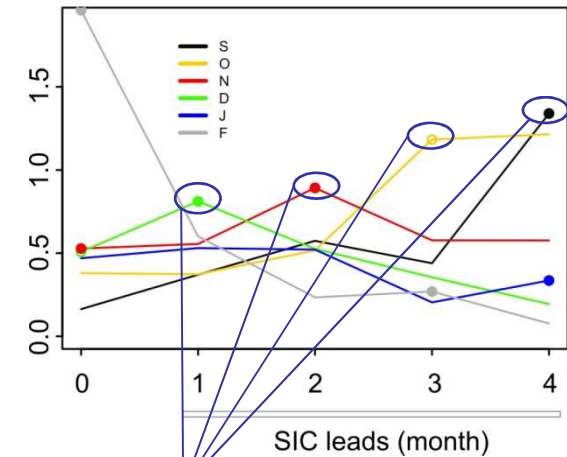
e) $\text{Z200} (\text{dec}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



f) $\text{Z050} (\text{dec}) \times \text{MCA-SIC}/eA_{\text{DEC}}$



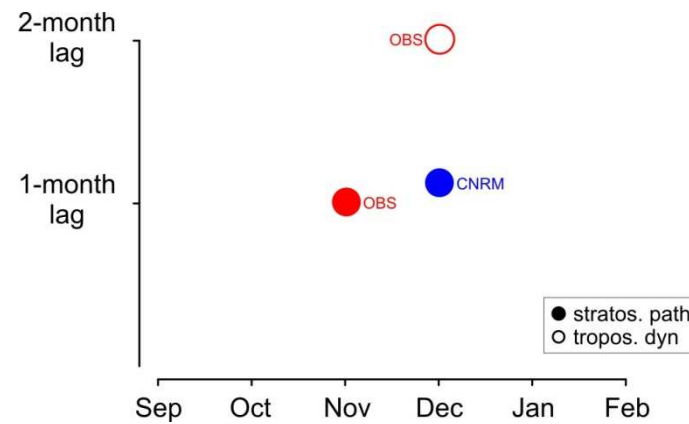
b) CNRM



SIC persistence from Sep to Dec;
sig. influence on the atm. – Jan

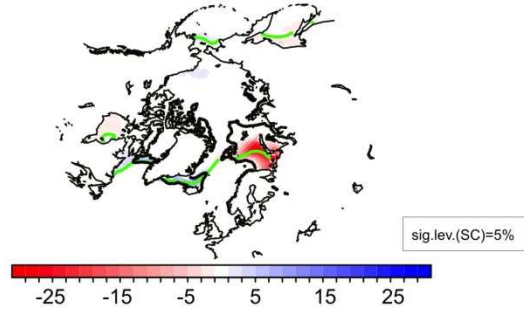


ECOMS Final Meeting (2016)

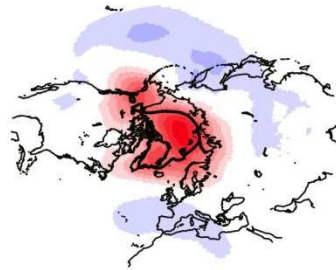


CCSM

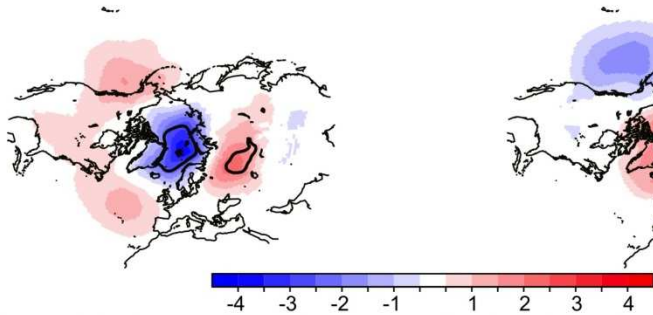
a) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SIC (dec)}$



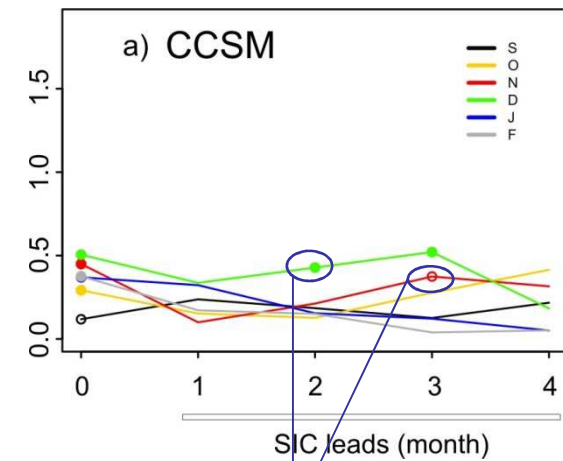
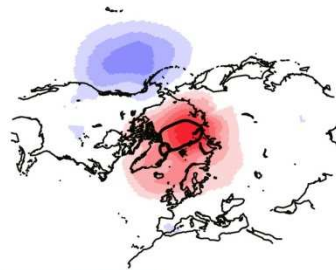
b) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SLP (feb)}$



c) $\text{SLP (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



d) $\text{SLP (jan)} \times \text{MCA-SIC}/eA_{\text{DEC}}$

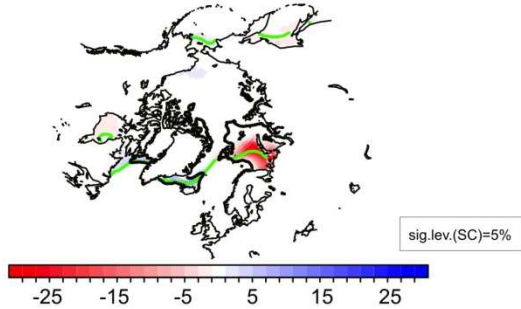


SIC persistence from Nov to Dec;
sig. influence on the atm. – Feb

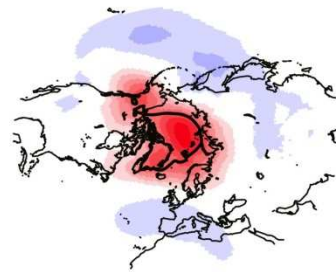
CCSM



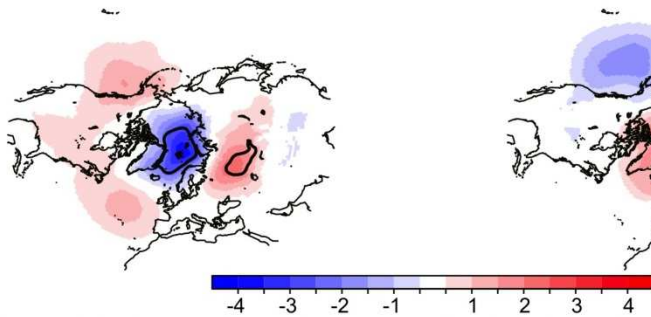
a) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SIC (dec)}$



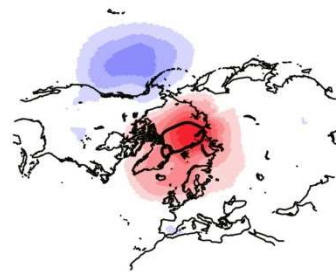
b) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SLP (feb)}$



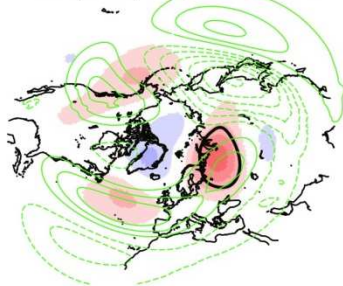
c) $\text{SLP (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



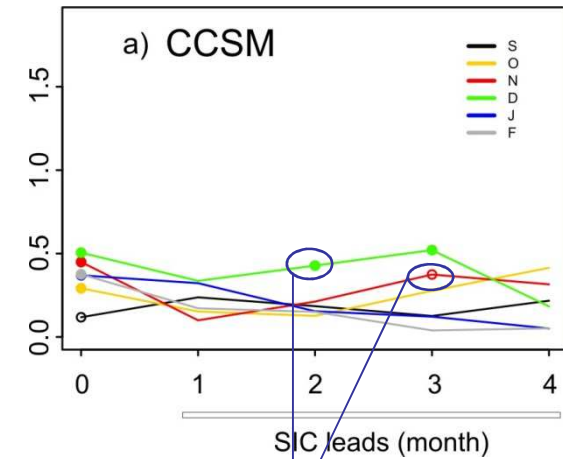
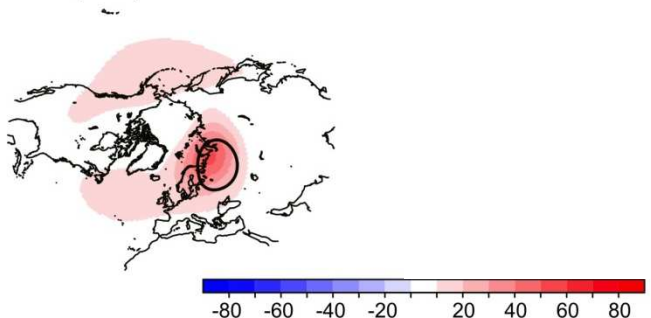
d) $\text{SLP (jan)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



e) $\text{Z200 (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



g) $\text{Z050 (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$

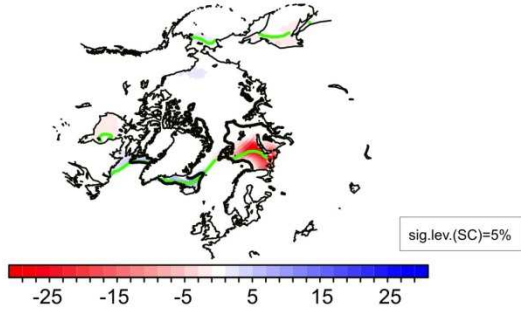


SIC persistence from Nov to Dec;
sig. influence on the atm. – Feb

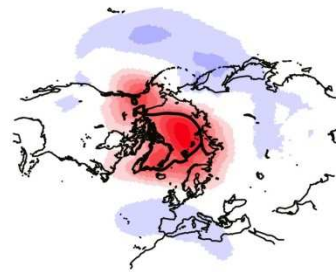
CCSM



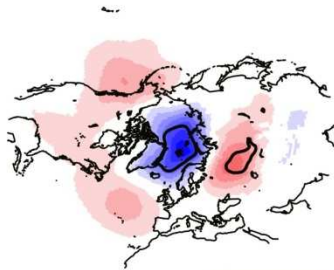
a) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SIC (dec)}$



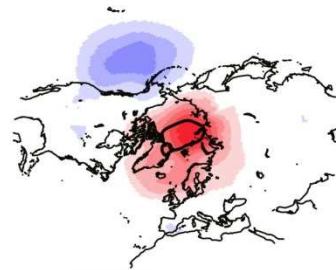
b) $\text{MCA-SIC}/eA_{\text{DEC}} \times \text{SLP (feb)}$



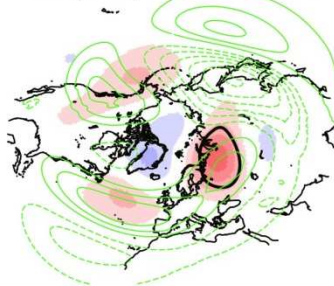
c) $\text{SLP (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



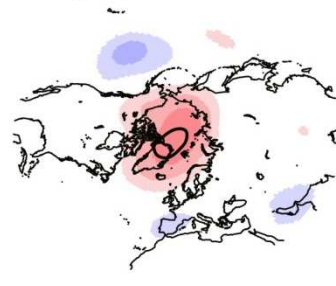
d) $\text{SLP (jan)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



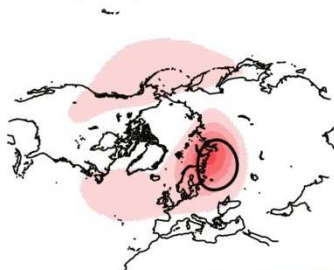
e) $\text{Z200 (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



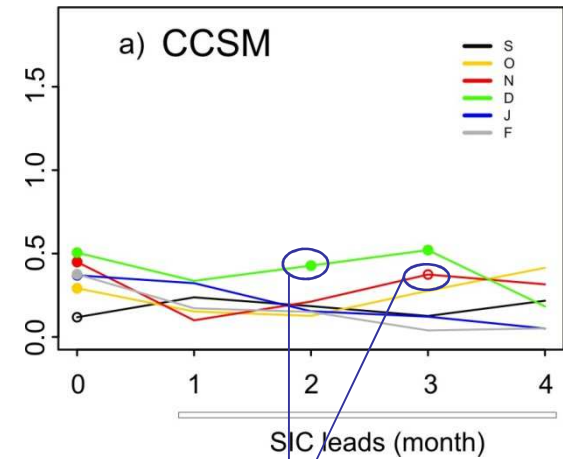
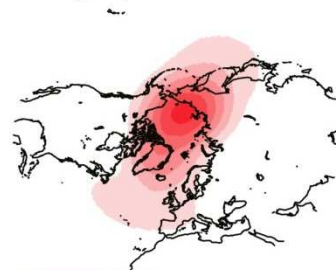
f) $\text{Z200 (jan)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



g) $\text{Z050 (dec)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



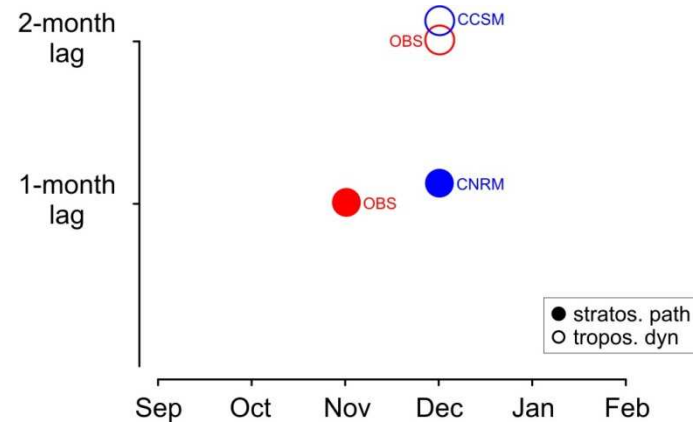
h) $\text{Z050 (jan)} \times \text{MCA-SIC}/eA_{\text{DEC}}$



SIC persistence from Nov to Dec;
sig. influence on the atm. – Feb

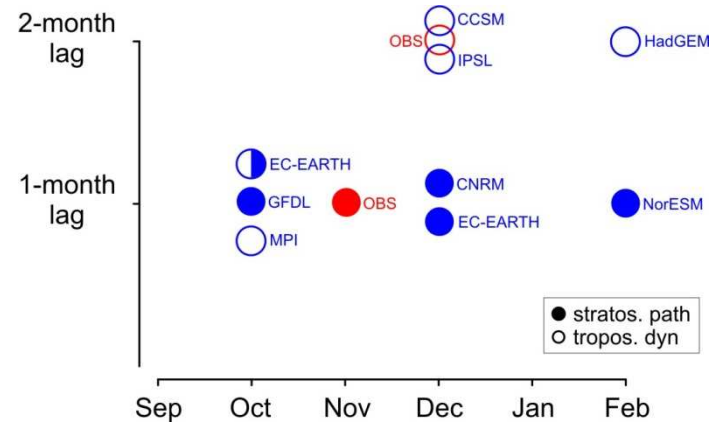


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SUMMARY

- CMIP5 models analysed here show a significant link with sea-ice reduction over the eastern Arctic (Greenland-Barents-Kara Seas) followed by a negative NAO-like pattern
- If the simulated relationship takes *one month* – the results suggest (in general) that a stratospheric pathway could be at play [in observations, this is shown for SIC in Nov]
- If the simulated relationship takes *two months* – the results suggest (in general) that tropospheric dynamics are dominant [in observations, this is shown for SIC in Dec]
- Target experiments are needed to gain insight into the role played by the background-flow

